Habits and Control of the FALL ARMYWORM

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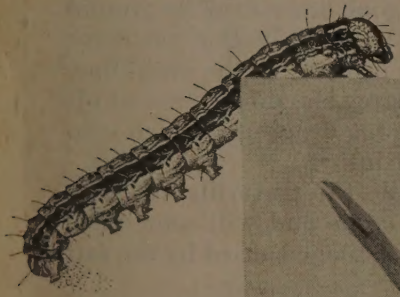

FARMERS' BULLETIN NO. 1990
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1950

THE FALL ARMYWORM is one of the most important insect enemies of cereal and forage, truck, and other field crops in the areas it invades in the United States.

Every farmer should watch carefully the grass growing among the cultivated field crops in the bottom lands or in low places of the fields. If he finds worms he should apply an insecticide (see p. 8 of this bulletin).

If the worms have already gone down into the ground to change to the pupal stage, light cultivation wherever possible will kill many of the insects. In the event they are on the march, a deep furrow should be plowed directly in front of them and a log dragged through it to kill the worms that have fallen into it.

The soil should be kept fertile, since a fertile soil stimulates a vigorous growth of crops and will sometimes enable them to recover from damage caused by the fall armyworm.

Clean culture should be practiced among the row crops, to destroy growing grass, upon which the fall armyworm first feeds. This practice sometimes prevents a serious infestation.

A poisoned-bran bait scattered broadcast over the infested field is often of great value in controlling the fall armyworm.

This bulletin is a revision of and supersedes Farmers' Bulletin 752, The Fall Armyworm, or Grassworm, and Its Control.

Washington, D. C. Issued July, 1950

HABITS AND CONTROL OF THE FALL ARMYWORM[1]

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THE FALL ARMYWORM ranks among the major pests of cereal and forage crops. During seasons of exceptional abundance the damage by this insect to grains, forage plants, cotton, garden vegetables, and other field crops throughout the area invaded totals many million dollars.

DISTRIBUTION AND HISTORY OF THE FALL ARMYWORM IN THE UNITED STATES

Since the fall armyworm is not able to survive the winter anywhere in the United States except in the extreme South, it is undoubtedly a native of tropical or subtropical America. Every summer it spreads northward by successive flights of the parent moths. It is called the fall armyworm because it does not reach the more northerly regions until late in the summer or early in the fall. During periodical outbreaks it may be found in almost all the States east of the Rocky Mountains (fig. 1). It also occurs in the Salt River Valley and at Yuma, Ariz. Ordinarily it is confined to the Southern States, but during years of exceptional abundance it has been observed in Canada. In the more southerly areas it is known locally by such names as "overflow worm," "grass worm," and "southern armyworm." This insect

[1] *Laphygma frugiperda* (A. and S.); order Lepidoptera, family Noctuidae.

[2] J. R. Watson, of the Florida Agricultural Experiment Station, and W. C. Nettles, of Clemson Agricultural College, furnished some of the information included under Control Measures.

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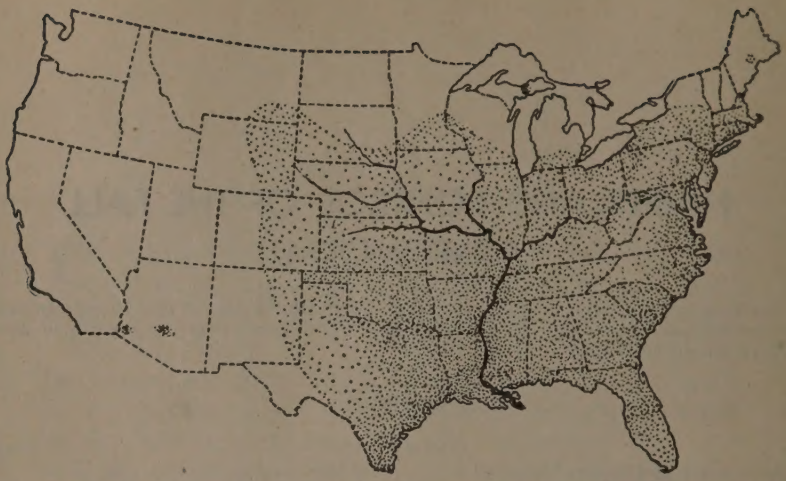

Figure 1.—Map showing area sometimes invaded by the fall armyworm. In the extreme southern portions of the area this pest is constantly present.

should not be confused with the true armyworm,[3] which often makes its appearance earlier in the season.

The fall armyworm has been known as an injurious insect in Georgia since 1797, and perhaps earlier. It is recorded as having been particularly injurious in Florida in 1845. In 1870 it was injurious in Missouri and Illinois, and from then until 1899 it caused more or less damage every few years. In 1899 an extensive outbreak occurred throughout South Carolina, North Carolina, Virginia, West Virginia, Indiana, Illinois, Missouri, Kansas, and other western and northern States. The most severe general outbreak of this insect ever recorded took place in the summer of 1912, when it swept almost the entire United States east of the Rocky Mountains, destroying corn and millet and severely injuring cotton and truck crops. Since 1912 there have been sporadic outbreaks of the caterpillars almost every year, but these have been confined mostly to the Southern States. Occasionally, however, their ravages have extended into more northerly regions.

CROPS ATTACKED

The favorite food plants of the fall armyworm are the native grasses, such as crabgrass, quackgrass, Bermuda grass, bluegrass, and Johnson grass, but it also attacks and sometimes seriously damages many cereal and forage crops, such as corn, kaffir, rice, oats, millet, alfalfa, clover, sorgo, and cowpeas. Frequently corn in the ear is seriously damaged by the larvae burrowing through the husk and feeding on the grain (fig. 2). Occasionally cotton is injured by the caterpillars cutting off the tops of the plants. During an outbreak year tobacco, grapes, and truck crops, such as potatoes, sweetpotatoes, turnips, spinach, cabbage, and cucumbers, are also attacked. Lawns in northern cities are sometimes completely denuded by these worms.

[3] The true armyworm (*Cirphis unipuncta* (Haw.)) is discussed in Farmers' Bulletin 1850, The Armyworm and Its Control.

WHEN OUTBREAKS MAY BE EXPECTED

General invasions by the fall armyworm almost invariably follow cold, wet springs. Such weather conditions are unfavorable for its insect enemies but are favorable for a luxuriant plant growth, upon which fall armyworm larvae thrive. In the South local outbreaks occur nearly every year after periods of heavy rainfall and humid weather.

Figure 2.—The fall armyworm feeding on corn in the ear.

LIFE HISTORY

The fall armyworm passes through the following four stages in its development: (1) The egg; (2) the larva, caterpillar, or worm; (3) the pupa, or resting stage; (4) the moth, or miller—sometimes called the adult, parent, or mature insect.

THE EGG

The eggs (fig. 3) are laid by the moths at night in clusters of 50 to several hundred, preferably on grass blades. Low-lying fields thickly covered with grass or small grains are often chosen for this purpose. Sometimes, however, especially in cities, the eggs are laid among the grass blades on lawns. The eggs are light gray, and are more or less thickly covered with grayish down from the moth's body. They hatch within 2 to 4 days in the South, but sometimes require 10 days in cooler climates.

THE CATERPILLAR, OR LARVA

The newly hatched caterpillars are very small and have jet-black heads and white bodies. They feed near the surface of the ground unnoticed. They feed first on the shells of the eggs from which they hatched, but soon begin to devour the crop.

Three or four days after hatching, the young caterpillars have grown rapidly, turned much darker in color, and begun to damage the crop. At this time they do not entirely consume the leaves of the food plant, but skeletonize them, leaving the veins and ribs and also leaving

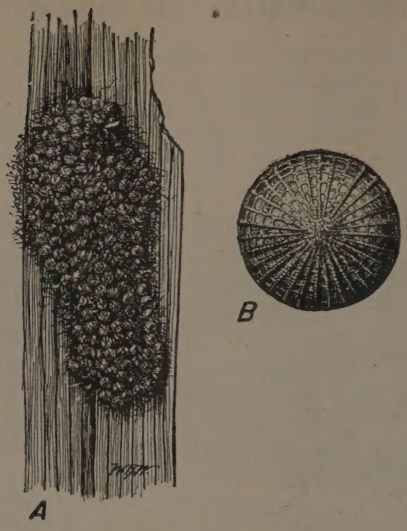

Figure 3.—Eggs of the fall armyworm: *A*, Egg mass, about twice natural size; *B*, highly magnified egg.

whitish patches which are conspicuous when seen against the healthy green parts of the leaf. The larvae may be found curled up in the leaf sheaths, or possibly suspended by threads, but are more likely to be on the ground under the injured plant.

Within 2 to 3 weeks after hatching, the caterpillar becomes fully grown. It is then striped, nearly naked, and about 1½ inches in length (fig. 4, *A*). The front of the head is usually marked with an inverted Y (fig. 4, *B*), but this character is not always sufficiently well marked to serve as a reliable means of identification. The color of the caterpillar ranges from light green to almost black. When nearly full grown the fall armyworms consume vast quantities of food, in comparison with their size. They devour every blade and leaf, leaving only the toughest parts of the plant stems, and if not yet full-grown they mass together and crawl or "march" in search of other food.

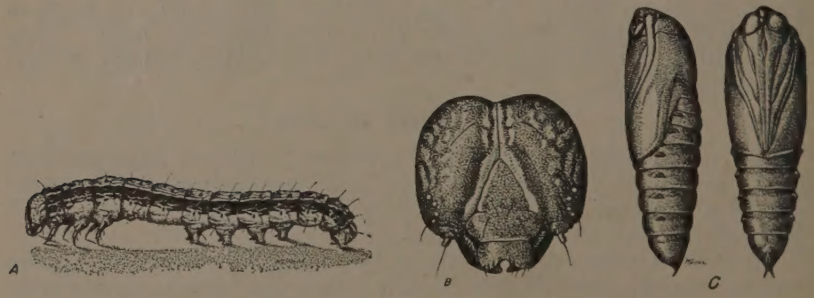

Figure 4.—The fall armyworm: *A*, Mature larva; *B*, head of larva, front view, greatly enlarged; *C*, pupa, about twice natural size.

When the caterpillar of the fall armyworm becomes full-grown it burrows into the soil an inch or two. By twisting and turning, it presses the earth away from its body on all sides and forms a small oval cell, within which it changes to the resting stage, or pupa.

THE PUPA

The pupa (fig. 4, *C*) of the fall armyworm is at first golden or reddish, but finally becomes almost black. Its body is covered with smooth, leathery skin. It has no legs, and is unable to move any part of its body but the abdomen. This stage lasts from 10 days to 2 weeks; then the skin of the pupa bursts and the moth crawls forth and makes its way immediately to the surface of the ground.

THE MOTH

The moth of the fall armyworm measures about ¾ inch in length and a little less than 1½ inches across its outspread wings. The body is ash gray. The forewings of the male (fig. 5, *A* and *C*) have a dark-

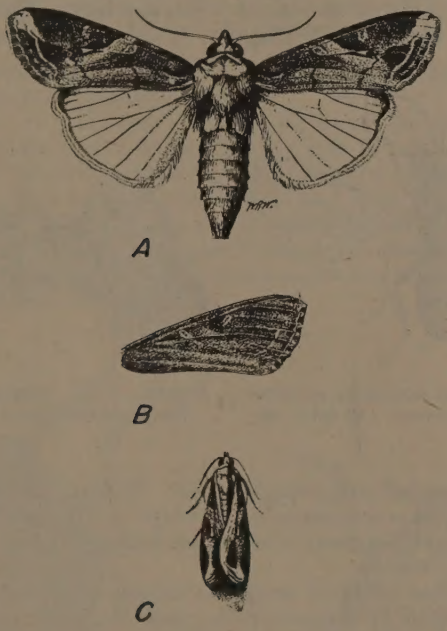

Figure 5.—The fall armyworm: *A*, Male moth; *B*, right front wing of female moth; *C*, moth in resting position. *A* and *B* about twice natural size; *C* very slightly enlarged.

gray ground color and a mottled appearance, with usually an irregular white or light-gray spot near the extreme tip. The forewings of the female (fig. 5, *B*) are usually much duller in color than those of the male. The hind wings of both sexes are white, with a pearly or pinkish luster, and are edged with a smoky-brown line.

In the Gulf States there may be as many as six generations of moths in a given locality in 1 year. In regions where the winter temperatures descend much below the freezing point, there is seldom or never more than one generation of the fall armyworm in a locality in 1 year, because the migrant moths, which sometimes fly hundreds of miles, do not reach these regions until late in the summer. Thus, as the insects cannot survive the winter in the North, infestations there are solely due to migratory moths coming from the South.

NATURAL ENEMIES

INSECT PARASITES AND PREDATORS

Fortunately the fall armyworm has several very efficient insect enemies, which ordinarily keep its numbers down and prevent serious outbreaks, except during years when conditions for the worm are exceptionally favorable.

In the southern part of the country several wasplike enemies are always present, one of the most effective being *Chelonus texanus* Cress., a small, black insect (fig. 6), which lays its eggs in the egg

Figure 6.—Chelonus texanus, a parasite of the fall armyworm. Greatly enlarged.

Figure 7.—A colony of *Euplectrus* larvae feeding on a fall armyworm.

deposited by the fall armyworm moth. Instead of destroying this egg, the young parasite remains inactive until the caterpillar has hatched and is partly grown, whereupon it devours the inside portions of the caterpillar's body.

Another of these effective wasplike enemies, *Euplectrus* sp., places her eggs on the back of the caterpillar near its head, and the parasitic larvae hatch out and begin to feed in this position. When the maggotlike larvae are full-grown (fig. 7), the caterpillar has a humped appearance and eventually dies.

Other valuable and effective insect enemies belong to a family of two-winged flies resembling the housefly. One of these, *Winthemia quadripustulata* (F.) (fig. 8), deposits its eggs on the body of the caterpillar. The maggots that hatch from these eggs bore into the caterpillar and soon kill it by devouring its internal organs and tissues. Another of these flies, *Archytas piliventris* (V. d. W.) (fig. 9), lays exceedingly tiny eggs on the food plants of the fall armyworm. These

Figure 8.—Winthemia quadripustulata, a parasite of the fall armyworm, enlarged.

Figure 9.—Archytas piliventris, a parasite of the fall armyworm. Greatly enlarged.

eggs are swallowed by the caterpillar with its food and hatch within its body into maggots that devour it.

Soldier bugs are numerous in some parts of the fall armyworm's range. One, known as the spined soldier bug (*Podisus maculiventris* (Say)) (fig. 10), kills the caterpillars by piercing them with its strong beak and sucking out the liquid contents of their bodies. Both the old and the young bugs (fig. 10, *A*, *B*) have this habit.

The fiery hunter (fig. 11), in both its larval and adult stages is a voracious feeder on insects and sometimes proves very efficient in controlling the fall armyworm.

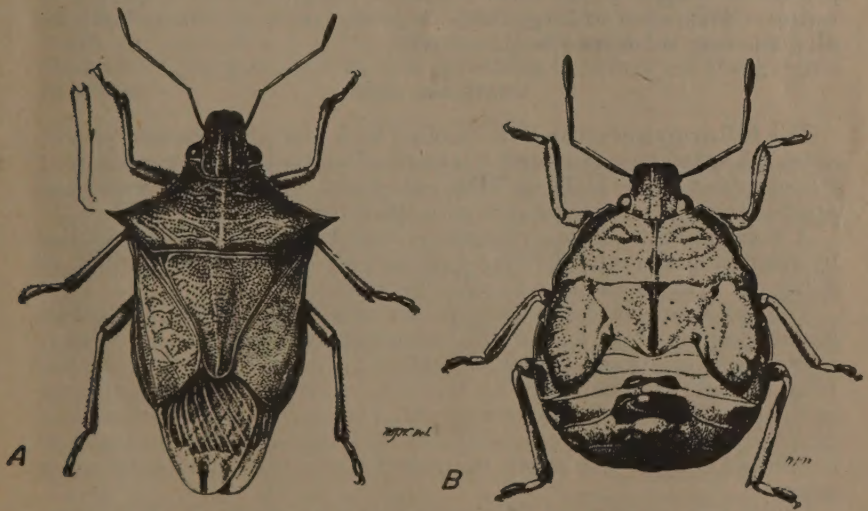

Figure 10.—The spined soldier bug, an enemy of the fall armyworm: *A*, Adult, greatly enlarged; *B*, a young spined soldier bug, much enlarged.

Figure 11.—Calosoma calidum, an enemy of the fall armyworm. *A,* Larva; *B,* beetle. Natural size. (After Riley.)

BIRDS AND ANIMALS

Among the important enemies of the fall armyworm are our common wild birds, including the crow, the blackbird or grackle, the yellow-headed blackbird, the chipping sparrow, the bluebird, the mockingbird, and the meadowlark. Domestic fowls, if allowed access to infested fields, will feed readily on the caterpillars.

Toads undoubtedly eat many caterpillars, and skunks feed on both the larvae and the pupae of this insect.

CONTROL MEASURES

Serious injury to cultivated crops by the fall armyworm can almost always be prevented if the farmer is on the alert to discover the insects when they first appear. Insecticides, poisoned-bran bait, or other suggested control measures should be applied immediately to infested grasses or crops. Every farm should be equipped with a sprayer or duster. Treatment of large fields or grassy areas and waste lands by airplane may sometimes be practicable.

SPRAYS AND DUSTS

The fall armyworm can be controlled with several of the new insecticides. A spray prepared with 2 pounds of wettable powder containing 50 percent of either DDT or TDE mixed with 40 gallons of water and applied in this amount per acre gives effective control.

A spray made up from a toxaphene emulsifiable concentrate, applied by aircraft at the rate of 1½ to 2 pounds of toxaphene in 2 gallons of spray per acre, should also control this pest.

The fall armyworm and the corn earworm often attack corn before and during tasseling, and in this connection are commonly referred to as "budworm." Good control of "budworm" in sweet corn has resulted from a single application of an emulsion made with 3 quarts of a 25-percent DDT emulsifiable concentrate, 5 quarts of a white mineral oil of 50 to 95 seconds Saybolt viscosity, and enough water to make 25 gallons of spray. The spray is applied at the rate of 25 gallons per acre.

Under some conditions dusts containing 5 percent of DDT, toxaphene, or TDE, at the rate of 40 pounds per acre, or a 20-percent

toxaphene dust at the rate of 10 to 15 pounds have given effective control of the fall armyworm.

CAUTION.—**All these insecticides are poisons. They must be kept out of reach of children or animals and must be handled with care, according to directions on the containers. Because of possible residue hazards to humans and livestock, hay or forage that has been treated with DDT, TDE, or toxaphene should not be fed to dairy animals or to meat animals being finished for slaughter.**

POISONED-BRAN BAIT

Under some conditions the poisoned-bran bait is of great value in controlling the fall armyworm. It is composed as follows: Wheat bran, 50 pounds; paris green or white arsenic, 2 pounds; water, about 6 gallons, or enough to make a damp but not sloppy mash. If wheat bran is unobtainable or scarce, barley or rice flour may be used. The bran and insecticide are first mixed together dry, the water is then added, and the whole mass is thoroughly mixed. In locations where the mixture dries out quickly, the addition of salt at the rate of 5 pounds to 50 pounds of bran tends to keep the bait moist and renders it more effective. The quantity mentioned is sufficient for 2 to 3 acres and should be broadcast thinly by hand, preferably early in the evening. Moderate infestations in corn may sometimes be controlled by light sprinklings of the bait in the leaf whorls. This bait is specially recommended for fields containing mixtures of grass and cowpeas, or cowpeas and sorgo, or fields in which the grass has been consumed by the caterpillars.

In areas where it is available, the standard grasshopper bait may be used, instead of the mixture described above, provided it is distributed at the same rate and in the same manner.

WARNING.—**Paris green and white arsenic are strong poisons. Prevent children or other persons, poultry, pets, or livestock of any kind from gaining access to them or to the bait. Thoroughly wash out receptacles after they have been used for mixing bait. Dispose of surplus bait by broadcasting it thinly on the ground in a field.**

CULTURAL CONTROL

Damage to field crops by the fall armyworm can often be prevented by keeping the crops free from grass. This insect is primarily a grass feeder, and breeds in grasses wherever possible. In the South after July, crabgrass and other native grasses grow luxuriantly among such field crops as corn and cotton, especially in lowlands. Destroying these grasses may prevent serious infestation and damage to the crops. Shallow cultivation of corn, cotton, and other row crops after the larvae have entered the soil to pupate is also recommended. Such cultivation kills many pupae and exposes others to the hot sun, which kills them in a short time.

In the event alfalfa is infested, some of the crop may be saved by cutting it immediately for hay. If the crop is not sufficiently developed to be cut, an application of poisoned-bran bait is recommended.

It is important that the soil be kept fertile, since a fertile soil stimulates vigorous plant growth and will sometimes enable the crops to recover from damage caused by the fall armyworm.

MECHANICAL CONTROL

Barriers

When the worms have exhausted the local food supply, they disperse in all directions. They may then be trapped by plowing a deep furrow at right angles to their course of advance. The worms that have fallen into this furrow may be killed by dragging a log through it, as shown in figure 12. Instead of using a drag, post holes a foot or more deep

Figure 12.—A ditch prepared to entrap fall armyworms. A log dragged back and forth through the ditch crushes the worms that have fallen into it.

are sometimes dug at intervals of about 20 feet in a furrow having a steep side opposite from which the worms are approaching. The worms crawl into the furrow, but cannot scale the far side, and they crawl along the bottom until they fall into the post holes. Here they may be crushed, or killed by pouring a little crankcase oil or kerosene over them. The furrows should be kept free from rubbish, so that the caterpillars will have no means of crossing to the opposite side.

Crushing the Larvae

In smooth lawns the larvae may be destroyed by using a steel lawn roller. This method is also applicable for field use if a large field roller is obtainable, but only where the larvae are crossing a smooth, hard surface, such as a road. In gardens, where it may be impracticable to spray, the worms may be shaken from the plants into receptacles containing a little kerosene.

Flooding

Sometimes a fall armyworm infestation in a lowland rice field can be controlled by flooding the field, thereby drowning the caterpillars. The water should be allowed to remain on the field at least 2 days.

SUMMARY OF CONTROL MEASURES

1. Enrich the soil. Keep it fertile. Plants injured by the fall armyworm have a better chance to recover in fertile soil than in poor soil.

2. Apply an insecticide. Prepare a spray by mixing 2 pounds of wettable powder containing 50 percent of either DDT or TDE with 40 gallons of water and apply in this amount per acre. A spray made up from a toxaphene emulsifiable concentrate may be applied by aircraft at the rate of 1½ to 2 pounds of toxaphene in 2 gallons of spray per acre.

Dusts containing 5 percent of DDT, toxaphene, or TDE, at the rate of 40 pounds per acre or a 20-percent toxaphene dust at the rate of 10 to 15 pounds per acre also have given good control.

To control "budworm" damage in sweet corn, spray with an emulsion made with 3 quarts of a 25-percent DDT emulsifiable concentrate, 5 quarts of a white mineral oil of 50 to 95 seconds Saybolt viscosity, and enough water to make 25 gallons of spray. Apply the spray at the rate of 25 gallons per acre.

3. Worms may be destroyed by broadcasting a poisoned bait thinly over the infested fields. Mix 50 pounds of wheat bran, barley flour, or rice flour with 2 pounds of paris green or white arsenic, and then add 6 gallons of water. This quantity will treat about 2 to 3 acres.

4. When the caterpillars are on the march, head them off by plowing a deep furrow directly in front of them, then kill the larvae that fall in this furrow by dragging a log through it, or dig post holes in the furrow about every 20 feet, in which the worms may be caught and killed. Keep the furrow free from rubbish, so that the larvae will have no means of crossing to the far side.

5. Grasses growing among row crops attract moths and start infestations. Keep them down by cultivation. After the caterpillars have gone down into the ground to change to the moth stage, cultivate the soil lightly wherever possible. This will cause the death of many of the pupae.

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